國立清華大學 102 學年度碩士班考試入學試題

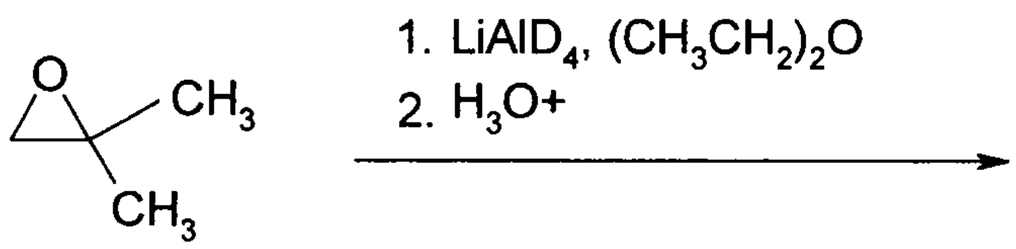
系所班組別：生醫工程與環境科學系甲組 (分子生醫工程組)

考試科目（代碼）：有機化學 (2204)

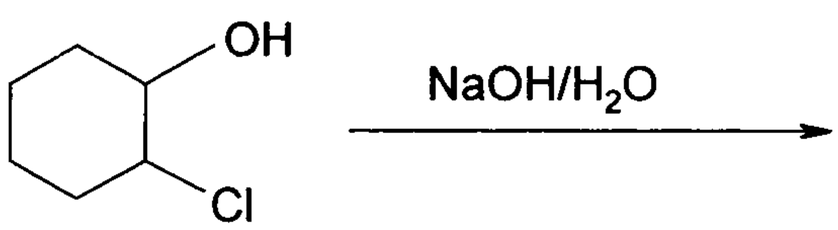
 *請在【答案卷、卡】作答

1. Please provide the structure of the major product(s) for each of the following reactions, and include stereochemistry where appropriate (30%, 3 % of each).

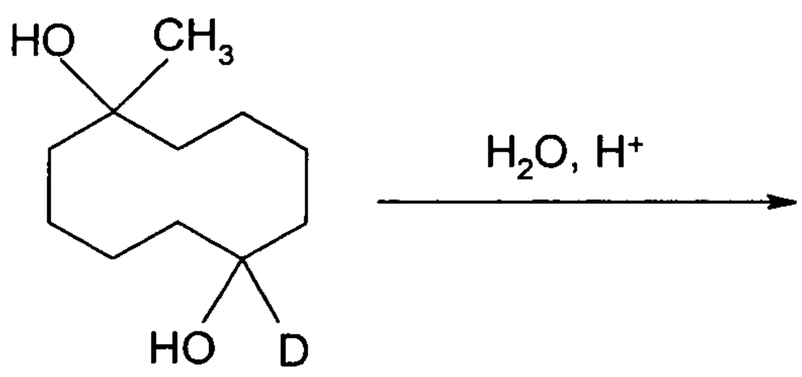
[A]



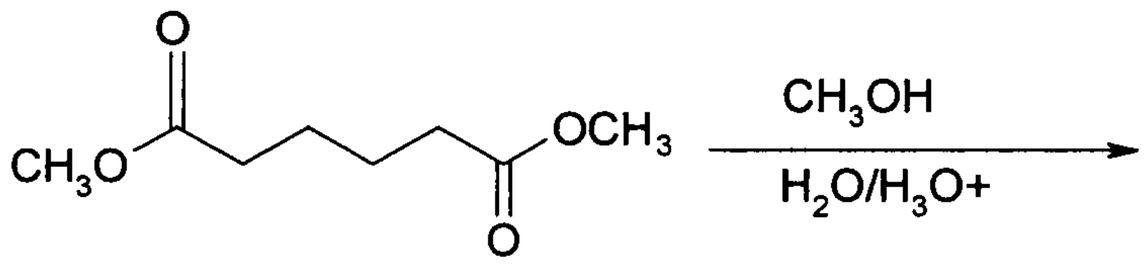
[B]



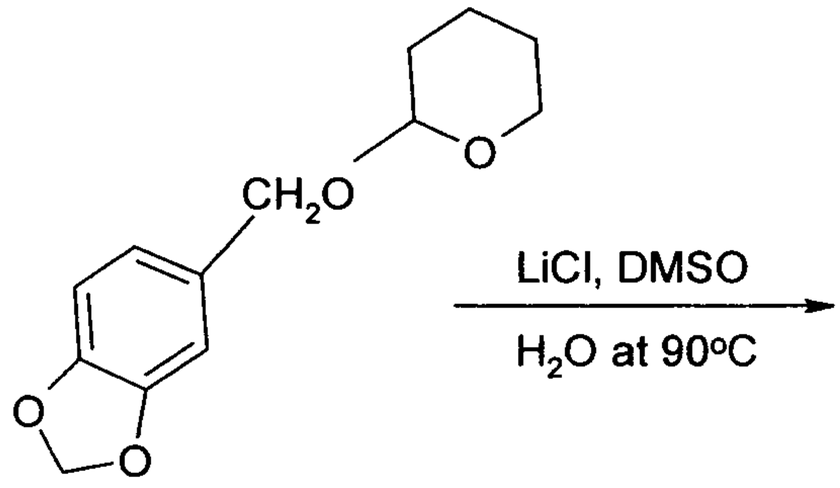
[C]



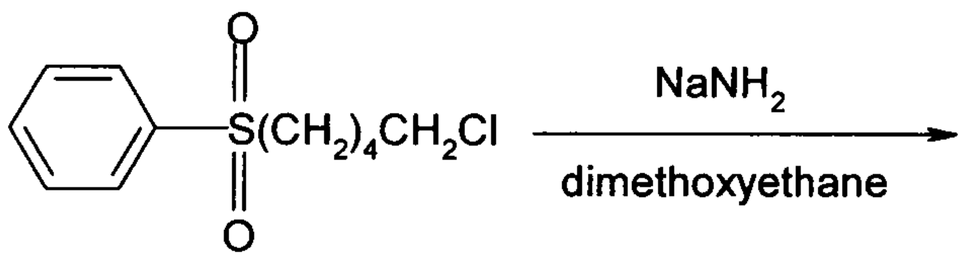
[D]



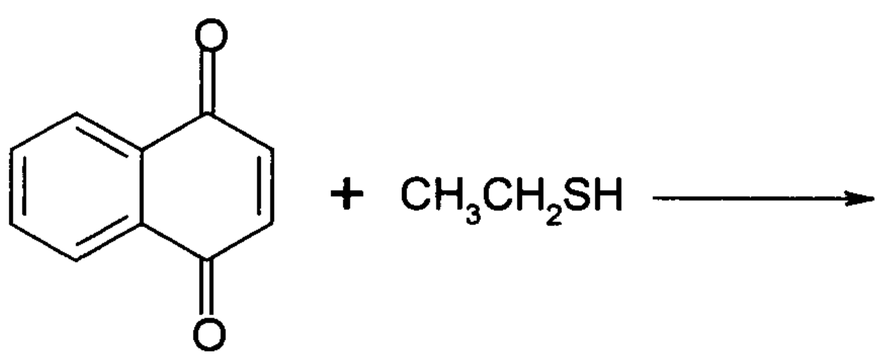
[E]



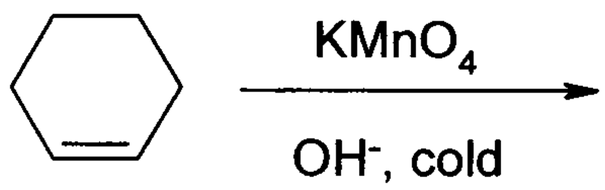
[F]


O
S(CH2)4CH2Cl
O
NaNH2
dimethoxyethane

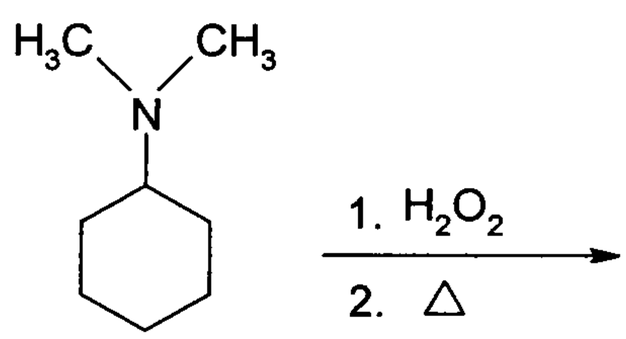
[G]


O
O
+ CH3CH2SH

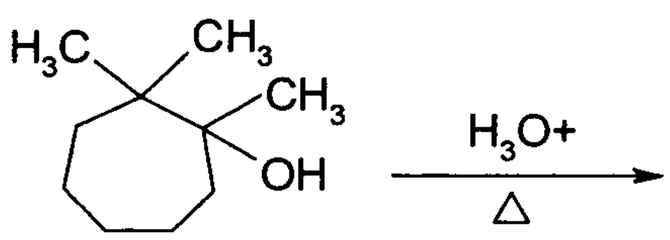
[H]


KMnO4
OH-, cold

[I]

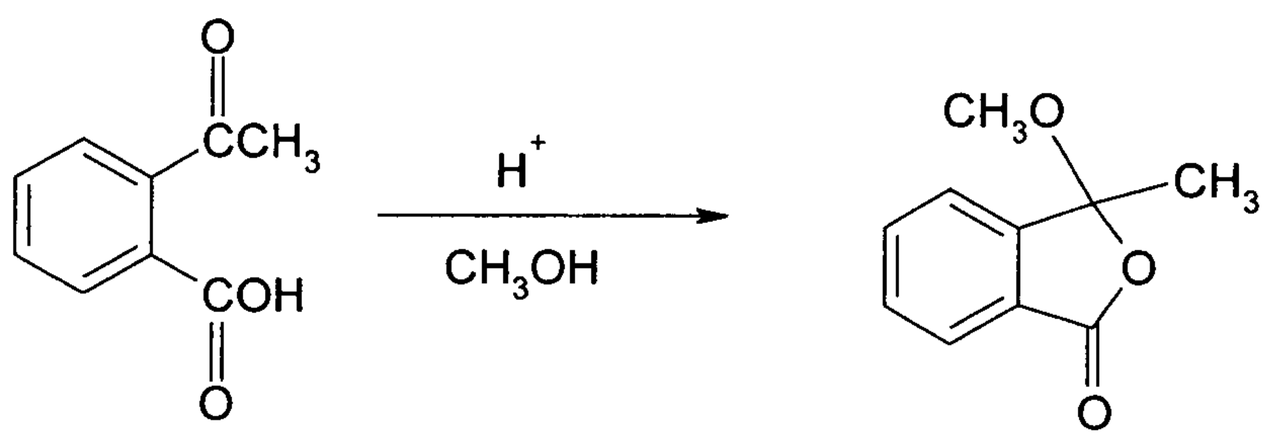

H3C
CH3
N
1. H2O2
2. △

[J]


H3C
CH3
CH3
OH
H3O+
△

2. Please propose a step-by-step reaction mechanism for the following reactions (26%)

[A]



(8%)

[B] Benzene reacts with sulfur dichloride in the presence of $AlCl_3$ to give diphenyl sulfide (C_6H_5-S-C_6H_5). Please propose a mechanism for this process. (8%)

[C] One mole of the acetyl chloride is added to a liter of triethylamine, resulting in a vigorous exothermic reaction results. The mixture was analyzed and found to contain triethylamine, ethyl acetate, and triethylammonium chloride. Please propose mechanisms for the **two exothermic reactions**. (10%)

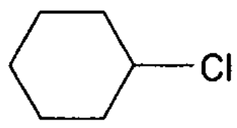
3. For each of the following questions, assume that all measurements are made in 10-cm polarimeter sample container. (6%)

[A] A 10-cm solution of 0.4 g of optically active 2-butanol in water displays an optical rotation of -0.56°. What is its specific rotation? (2%)

[B] The specific rotation of sucrose is + 66.4. What would be the observed optical rotation of such a solution containing 3 g of sucrose? (2%)

[C] A solution of pure (*S*)-2-bromobutane in ethanol is found to have an observed $[\alpha_D^{25^oC}]$ = +57.3. If $[\alpha]$ for (*S*)-2-bromobutane is 23.1, what is the concentration of the solution? (2%)

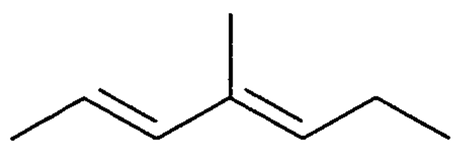
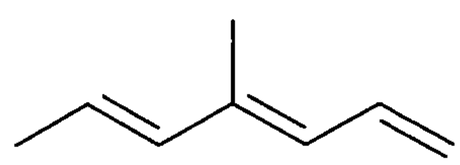
4. Rank each of the following sets of molecules in order of increasing S_N2 reactivity. (9%)

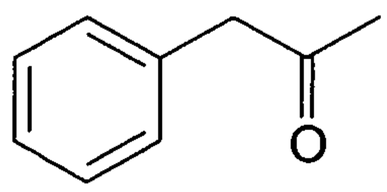
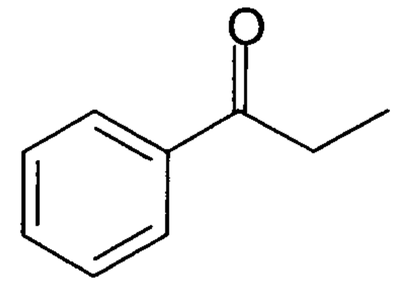
[A] CH_3CH_2Cl, CH_3CH_2I, 

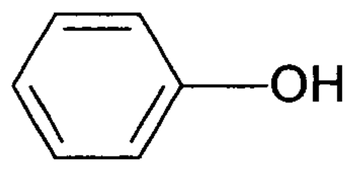
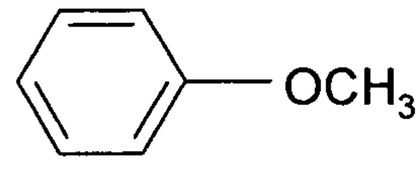
[B] CH_3CH_2Br, CH_3Br, $(CH_3)_2CHBr$, $CH_3CH_2CH_2Br$.

[C] $(CH_3CH_2)_2CHCH_2Br$, $(CH_3)_2CHCH_2Br$, $CH_3CH_2CH_2CHCH_3Br$

5. How could you distinguish between the compounds in each of the following pairs using UV spectroscopy? (9%)

[A]  and 

[B]  and 

[C]  and 

6. When compound A ($C_5H_{12}O$) is treated with HBr, it forms compound B ($C_5H_{11}Br$). The ^1H NMR spectrum of compound A has one singlet (1), two doublets (3, 6), and two multiplets (both 1) (number in parentheses are the relative areas of the signals). The ^1H NMR spectrum of compound B has a singlet (6), a triplet (3), and a quarter (2). Please identify compounds A and B. (8%)

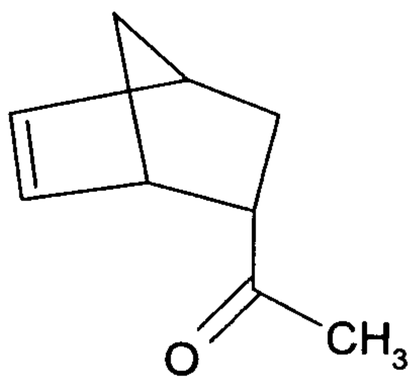
7. Using any necessary inorganic reagents, show how you would convert acetylene and isobutyl bromide to the following compounds. (6%)

[A] *meso*-2,7-dimethyl-4,5-octanediol, $(CH_3)_2CHCH_2CH(OH)CH(OH)CH_2CH(CH_3)_2$

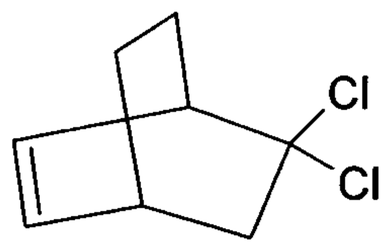
[B] (±)-2,7-dimethyl-4,5-octanediol

8. Which diene and which dienophile could be used to prepare each of the following compounds? (6%)

[A]



[B]



[C]